



HUMAN &
ENVIRONMENTAL
EXPOSURE
ASSESSMENT OF
NANOMATERIALS

National
Nanotechnology
Initiative

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www.nano.gov/html/meetings/exposure



Day 1

- Where are we in addressing research needs?
- Where do we need to be in addressing research needs in 5 years?
- Are the current research needs framed correctly in consideration of evolving understanding of the state of the science? What are the emerging trends?
- Technical Questions



Research Need #1

Characterize exposure among workers

- Where are we in addressing research needs?
 - ✓ potentially exposed groups of workers could be systematically identified through national survey, stewardship and tracking life cycle, possible registry
 - ✓ existing public health (GIS) are probably poorly suitable for workers
 - ✓ personal exposures can be measured, but specificity is the challenge
 - ✓ there are adequate emission measurement protocols as a starting point
 - ✓ exposure registries are feasible recognizing limitations



Research Need #1 Characterize exposure among workers

- Where do we need to be in addressing research needs in 5 years?
 - ✓ Conduct a national survey of potential occupational exposures in nanotechnology (National Occupational Exposure Survey)
 - ✓ Identify workers potentially exposed to ENM through existing mechanisms and frameworks (EPA NMSP)
 - ✓ Develop new models for ENM emissions and transport based on experimental data
 - ✓ Exposure registries are not only feasible, they are essential



Research Need #2 Identify population groups ...

- Where are we in addressing research needs?
 - ✓ Source-to-Dose Assessments for chemicals
 - ✓ Some information about the manufacturing sources of ENM emissions to the environment
 - ✓ Previous analyses of aggregate and cumulative exposure
 - ✓ Measurements of UF exposure levels
 - ✓ Biomarkers of exposures to UF
 - ✓ Existing sets of inventories for chemicals (Toxics Release Inventory, National Emissions Inventories, Clean Air Markets Database, National Pollutant Discharge Elimination System permits)



Research Need #2

Identify population groups ...

- Where are we in addressing research needs?
 - ✓ Existing sets of inventories for chemicals (Toxics Release Inventory, National Emissions Inventories, Clean Air Markets Database, National Pollutant Discharge Elimination System permits)
 - ✓ Existing models for transport and contact (Air: CMAQ, AERMOD, CALPUFF; Water: PRZM, EXAMS, EPANET; Exposure: HEM, SHEDS, new or proprietary product use information, etc)
 - ✓ Routine monitoring programs (Air: SLAMS, NAMS, STN, IMPROVE, CASTNET, etc.; Water: National Aquatic Resource Surveys, municipal drinking water assays; Food: Surveys conducted by FDA, USDA, and EPA)
 - ✓ Records of body burdens based on biomarkers (CDC National Exposure Report Card, EPA National Human Exposure Assessment Survey, National Children's Study, etc.)

The slides represent what the author heard from presentations and breakout summaries and, as such are not intended to provide a comprehensive list of all points raised or prevailing views. Neither do the slides represent the views of either the author or NIOSH.



Research Need #2 Identify population groups ...

- Where do we need to be in addressing research needs in 5 years?
 - ✓ Develop a method to prioritize needs
 - ✓ Consider exposures through whole life cycle of the product
 - ✓ Review possible exposure pathways
 - ✓ Review modifications of ENM (decomposed, biologically altered, UV, consumed, etc)
 - ✓ Systematically identify biomarkers (better target data collection methods)
 - ✓ Review existing data-bases (sales, insurance, hospital)



Characterize exposure to the general population

- Where are we in addressing research needs?
 - ✓ There are some tools available to characterize and measure relevant attributes of nanomaterials, including particle size, number, and surface area for these exposure
 - ✓ We can do some measurements of nanomaterials and degradation products in various media through the lifecycle of materials
 - ✓ Some data on emission of ENM from consumer products during their application



Characterize exposure to the general population

- Where do we need to be in addressing research needs in 5 years?
 - ✓ Develop operational roadmap for population exposures to nanomaterials
 - ✓ Analyze product use and measure exposure
 - ✓ Validate techniques
 - ✓ Analyze emissions/effluent and characterize at point of contact
 - ✓ Develop and validate models
 - ✓ Analyze sources and characterize dose
 - ✓ Develop tools for prioritization of study scope and object
 - ✓ Releases of engineered nanomaterials must be studied based upon NM production, processing, uses and disposal/reuse



Characterize health of exposed populations ...

- Where are we in addressing research needs?
 - ✓ Prospective studies of ultra-fine air pollutants (and possibly diesel particulates)
 - ✓ Medical monitoring beginning at some laboratories and companies
 - ✓ Prototypical surveillance systems (NIOSH preplanned cohort studies, NIOSH field epi, CPSC NEISS, FDA passive postmarket surveillance, etc.)



Characterize health of exposed populations ...

- Where do we need to be in addressing research needs in 5 years?
 - ✓ Expand NHANES and NHIS to include consumer products
 - ✓ Cluster investigations of both occupational and public health
 - ✓ Conduct industry-wide studies of defined cohorts by NIOSH, Industry or Labor
 - ✓ Need an ongoing consensus process to establish a set of sentinel events that would trigger investigation



Understand workplace processes and factors ...

- Where are we in addressing research needs?
 - ✓ Some data on potential determinants of exposure across NM industry and product type (ICON)
 - ✓ Limited studies of potential determinants of exposure at organizational level and NM type (carbon black)
 - ✓ Limited data on potential determinants of exposure at operational and process level (welding fumes, carbon-based NM, metal oxides, functionalized NM, nanocomposites)



Understand workplace processes and factors ...

- Where do we need to be in addressing research needs in 5 years?
 - ✓ Develop harmonized survey approach
 - ✓ Develop walkthrough protocol to id sources including potential dermal sources
 - ✓ Develop methods to characterize inhalation exposures (particle size/count/surface area) as well composition
 - ✓ Develop methods to characterize potential dermal exposures
 - ✓ Prioritize exposure determinants & processes for surveys



- Are the current research needs framed correctly in consideration of evolving understanding of the state of the science? What are the emerging trends?
 - ✓ Develop Informatics approaches
 - ✓ Consider Agglomeration and De-agglomeration effects
 - ✓ Develop Instrumentation
 - ✓ Consider Global Issues
 - ✓ Develop Hazard Categories
 - ✓ Establish Test Facilities
 - ✓ Establish Registries
 - ✓ Consider Second Generation NM and Beyond



Day 2

8:00	Recap of Day 1
8:15	Break-out discussions on general issues
10:45	Break
11:15	Open discussion on path forward
12:30	Closing



Day 2

- What is the role of informatics and how exchange of information could be made more efficient?
- How can cross-cutting research issues be addressed?
- What are the barriers for addressing cross-cutting research issues?
- What is the role of government/academia/industry/NGOs?
- What mechanisms exist or should be established to address research needs?